

NEPP COTS MEMS Programs

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ABSTRACT

During the last decade, research and development of microelectromechanical systems (MEMS) has shown a significant promise for a variety of commercial applications including automobile and medical purposes. For example, accelerometers are widely used for air bag in automobile and pressure sensors for various industrial applications. Some of the MEMS devices have potential to become the commercial-off-the-shelf (COTS) components. While high reliability/harsh environmental applications including aerospace require much more sophisticated technology development, they would achieve significant cost savings if they could utilize COTS components in their systems.

NASA Electronics Parts and Packaging (NEPP) is initiating COTS MEMS program with the objectives of understanding quality and reliability assurance issues associated with implementation of this MEMS technology and help to build needed infrastructure. Similarly, to JPL-led consortia on COTS IC packaging programs^{1,2}, it is intended to form an industry-wide consortium from aerospace, military, and commercial sectors. A collaborative research program has already been initiated with Glenn Research Center on pulling expertise of each center to understand issues associated with the use of COTS pressure sensor for measuring airflow of inlet compressor of a turbofan propulsion systems and extend for potential other applications.

Another collaboration which is in its developmental stage that has a potential of becoming a future COTS MEMS, which is the development of the Giant Magnetoresistive (GMR) sensors. The objectives are to build GMR sensors that are smaller and more sensitive than capacitive and more robust than tunneling accelerometers sensors. In addition, there are numerous JPL internal development on MEMS activities including monolithic sensors for the accurate measurement of magnetic field intensity. Magnetic MEMS sensor development aimed to replace conventional flux-gate sensors, reducing size and improving the field measurement accuracy.

This paper reviews the current status of MEMS packaging technology from COTS to specific applications, provides lessons learned, and finally, identifies a need for a systematic approach for this purpose similar to those currently being carried out for IC packaging.

Keywords: Commercial-Off-The-Shelf, COTS, Microelectromechanical Systems, MEMS, Reliability, Pressure Sensors, Accelerometer, GMR, Magnetic Sensors, and Aerospace Environment

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